IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of: FRENKEL
Serial No.: 10/024,048
Filed: December 14, 2001

For: ADAPTIVE RATE TRANSMISSION WITH DUAL NOISE MARGINS

Group Art Unit: 2611
Examiner: Sudhanshu Pathak

RULE 132 DECLARATION OF ILAN REUVEN

I, the undersigned, Ilan Reuven of 6 Yohanan Bader Street, Ramat Gan, Israel, hereby declare as follows:

1. During the period from June, 2000, through February, 2002, I served as Chief Scientist of Tioga Technologies Inc., the assignee of U.S. Patent Application No. 10/024,048 (hereinafter "the Application"). During this period, Liron Frenkel, who is the inventor in the Application, was also employed by Tioga Technologies and worked with me on development of DSL technology.

2. In January, 2001, I joined Study Group 15 of the ITU - Telecommunication Standardization Sector. This Study Group was charged with defining certain aspects of the G.shdsl draft recommendation regarding Single-pair High-speed DSL (SHDSL). Prior to my joining, this Study Group prepared a contribution for discussion at a meeting to be held in Clearwater, Florida, January 8-12, 2001, regarding the "Proposed PMMS Target Margin" to be used in the recommendation. This contribution was identified as Temporary Document CF-042R2, and is attached hereto as Annex A.

3. In the course of the above-mentioned meeting in January, 2001, Liron Frenkel described to me the invention covered by claim 1 in the Application, according to which a transmission rate may be selected based on both worst-case and current-condition target margins. I then proposed this idea to the Study Group for inclusion in the above-mentioned contribution.

4. In response to my proposal, the Study Group agreed to incorporate Frenkel's invention in the contribution. A revised contribution (CF-042R3, attached hereto as Annex B), was prepared accordingly. The revised contribution contains (in section 6.3.6) language specifying the use of transmission rate selection based on both worst-case and current-condition target margins. This language was approved for adoption in the G.shdsl recommendation at the above-mentioned meeting.

5. As a final clarification, I note that the people whose names appear as "contacts" at the bottom of the first page in each of Annexes A and B (including my own name in Annex B) were listed simply in their capacities as members of the Study Group, representing their respective companies, and not necessarily as originators of the ideas incorporated in the contributions. In the present case, Liron Frenkel was the sole inventor of the invention in question, and my role was limited to conveying Frenkel's idea to the Study Group.

In Re: U.S.S.N. 10/024,048
Group Art Unit 2611
Rule 132 Declaration of Ilan Reuven cont'd

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and conjecture are thought to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

Ilan Reuven, Citizen of Israel
6 Yohanan Bader Street, Ramat Gan, Israel

Date: June 5, 2006

ANNEX A

ITU - Telecommunication Standardization Sector Temporary Document CF-042R2

STUDY GROUP 15 Original: English

Clearwater, Florida, USA, 08–12 January 2001

Question: 4/15

SOURCE[1]: Alcatel USA, Centillium, Globespan, Adtran, Conexant, Virata

TITLE: G.shdsl: Proposed PMMS Target Margin

ABSTRACT

While Annex A and Annex B of the current G.shdsl draft recommendation specify performance requirements for specific data rates, no method for specifying a target margin used during PMMS (line probe) is provided. This contribution proposes target margin negotiated during the G.hs transaction and used during PMMS for G.shdsl.

1. Introduction:

Currently there is no target margin parameter specified for use during the PMMS (line probe) of G.shdsl, therefore the margin assumed by the receiver is vendor defined. By specifying a target margin in the G.hs transaction prior to line probe, the transmitter will know how PMMS results are determined.

2. Implementation of Target Margin:

Target margin can be relative to current line conditions or expected worst-case conditions. If current conditions are used, then retrains may occur if disturbers are added or loop conditions change in a manner that the feed-forward section of the equalizer cannot track. To guarantee that the link stays active, large values of target margin may be required. However, if conditions are already worst-case, this results in wasted margin, and, consequently, lower bit rate.

Basing target margin on expected worst-case conditions puts the intelligence in the receiver: A certain level of performance is guaranteed in worst-case conditions. Approximate worst-case conditions for symmetric PSDs are 49 self-NEXT disturbers. For 768/776 kbps asymmetric PSDs in Annex A, test cases 33 and 36 are approximately worst-case, and only have NEXT components. For 1536/1544 kbps asymmetric PSDs in Annex A, test cases 5 and 8 from Table A-1 represent approximate worst-case conditions, and the FEXT components are negligible. For the asymmetric PSDs of Annex B, 49 symmetric PSD G.shdsl disturbers at the same bit rate approximate worst-case noise.

For some applications, the performance guarantee may be less important, and occasional retrains may be acceptable in order to obtain the highest bit rate. For this reason, we propose that PMMS target margin may also be based on current conditions.

3. Draft Text:

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3.1 G.shdsl

3.1.1 Main Body

6.3.6. PMMS Target Margin

PMMS target margin is used by the receiver to determine if a data rate can be supported with this margin under current noise or reference worst-case noise specified in Annex A and Annex B. A data rate may be included in the capabilities list resulting from line probe only if the estimated SNR associated with that data rate minus the SNR required for BER=10^{-7} is greater than or equal to target margin in dB.

The use of negative target margins with respect to reference worst-case noise corresponds to reference noise with fewer disturbers. This may be applicable when the number of disturbers is known to be substantially fewer than specified by the reference worst-case noise. Use of negative target margins with respect to current-conditions is not advised. Use of the current-condition target margin mode may result in retrains if the noise environment changes significantly.

6.4.1

PMMS Target Margin - If worst-case target margin is selected, target margin is relative to reference worst-case crosstalk specified in Table A-X and Table B-X. If current-condition target margin is selected, specified target margin is relative to noise measured during line probe. The 5 bit target margin is specified by (bits 5-1 x 1.0 dB) - 10 dB. For example, 101111_2 corresponds to 15 dB-10dB=5dB target margin relative to reference worst-case noise.

3.1.2 Annex A

A.5.4 PMMS Target Margin

If the optional line probe is selected during the G.994.1 session, the receiver shall use the negotiated target margin. If worst-case PMMS target margin is selected, then the receiver shall assume the disturbers of Table A-X to determine if a particular rate can be supported. Reference crosstalk shall be computed as defined in A.3.3 with the FEXT components in A.3.3.9 ignored. The reference crosstalk specified in this section may not be representative of worst-case conditions in all networks. Differences between crosstalk environments may be compensated by adjusting the target margin.

Table A-X: Reference disturbers used during PMMS for worst-case target margin

Rate (kbps)	PSD (direction)	Reference disturber
all	symmetric (US/DS)	49 SHDSL
768/776	asymmetric (US)	49 HDSL
768/776	asymmetric (DS)	24 T1+24 HDSL
1536/1544	asymmetric (US)	39 SHDSL (NEXT only)
1536/1544	asymmetric (DS)	24 T1+24 SHDSL (NEXT only)

3.1.3 Annex B

B.5.4 PMMS Target Margin

If the optional line probe is selected during the G.994.1 session, the receiver shall use the negotiated target margin. If worst-case PMMS target margin is selected, then the receiver shall assume the disturbers of Table B-X to determine if a particular rate can be supported. Reference crosstalk shall be computed using the cable crosstalk models of B.3.5.2, assuming infinite loop length so that FEXT components are ignored and NEXT is independent of loop length. The reference crosstalk specified in this section may not be representative of worst-case conditions in all networks. Differences between crosstalk environments may be compensated by adjusting the target margin.

Table B-X: Reference disturbers used during PMMS for worst-case target margin

Rate (kbps)	PSD (direction)	Reference disturber
all	symmetric (US/DS)	49 SHDSL
2048	asymmetric (US)	49 SHDSL-SYM with fsym=685333 Hz
2048	asymmetric (DS)	49 SHDSL-SYM with fsym=685333 Hz

2304	asymmetric (US)	49 SHDSL-SYM with fsym=770667 Hz
2304	asymmetric (DS)	49 SHDSL-SYM with fsym=770667 Hz

3.2 G.hs

Two new octets for Annex A and Annex B operation are proposed:

Table 11.14.3.12/G.994.1 – Standard information field – G.991.2 Annex A Downstream PMMS parameters - NPar(3) coding – Octet 13

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A downstream PMMS NPar(3)s – Octet 13
x	x	1	x	x	x	x	x	Worst-case PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	x	x	x	x	x	Current-condition PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)

Table 11.14.4.12/G.994.1 – Standard information field – G.991.2 Annex A Upstream PMMS parameters - NPar(3) coding – Octet 13

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A upstream PMMS NPar(3)s – Octet 13
x	x	1	x	x	x	x	x	Worst-case PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	x	x	x	x	x	Current-condition PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB

These octets should be duplicated as Tables 11.16.3.12 and 11.16.4.12 respectively for Annex B PMMS parameters.

4. Summary:

1. This item should be presented under G.shdsl.
2. We propose that the text from section 3.1 of this contribution be included in the G.shdsl draft recommendation.
3. We propose that the octets from section 3.2 of this contribution be included in the G.hs-bis draft recommendation.

ANNEX B

ITU - Telecommunication Standardization Sector Temporary Document CF-042R3

STUDY GROUP 15 Original: English

Clearwater, Florida, USA, 08–12 January 2001

Question: 4/15

SOURCE[1]: Alcatel USA, Centillium, Globespan, Adtran, Conexant, Virata, Tioga

TITLE: G.shdsl: Proposed PMMS Target Margin

ABSTRACT

While Annex A and Annex B of the current G.shdsl draft recommendation specify performance requirements for specific data rates, no method for specifying a target margin used during PMMS (line probe) is provided. This contribution proposes target margin negotiated during the G.hs transaction and used during PMMS for G.shdsl.

1. Introduction:

Currently there is no target margin parameter specified for use during the PMMS (line probe) of G.shdsl, therefore the margin assumed by the receiver is vendor defined. By specifying a target margin in the G.hs transaction prior to line probe, the transmitter will know how PMMS results are determined.

2. Implementation of Target Margin:

Target margin can be relative to current line conditions or expected worst-case conditions. If current conditions are used, then retrains may occur if disturbers are added or loop conditions change in a manner that the feed-forward section of the equalizer cannot track. To guarantee that the link stays active, large values of target margin may be required. However, if conditions are already worst-case, this results in wasted margin, and, consequently, lower bit rate.

Basing target margin on expected worst-case conditions puts the intelligence in the receiver: A certain level of performance is guaranteed in worst-case conditions. Approximate worst-case conditions for symmetric PSDs are 49 self-NEXT disturbers. For 768/776 kbps asymmetric PSDs in Annex A, test cases 33 and 36 are approximately worst-case, and only have NEXT components. For 1536/1544 kbps asymmetric PSDs in Annex A, test cases 5 and 8 from Table A-1 represent approximate worst-case conditions, and the FEXT components are negligible. For the asymmetric PSDs of Annex B, 49 symmetric PSD G.shdsl disturbers at the same bit rate approximate worst-case noise.

For some applications, the performance guarantee may be less important, and occasional retrains may be acceptable in order to obtain the highest bit rate. For this reason, we propose that PMMS target margin may also be based on current conditions.

3. Draft Text:

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3.1 G.shdsl

3.1.1 Main Body

6.3.6. PMMS Target Margin

PMMS target margin is used by the receiver to determine if a data rate can be supported with this margin under current noise and/or reference worst-case noise specified in Annex A and Annex B. A data rate may be included in the capabilities list resulting from line probe only if the estimated SNR associated with that data rate minus the SNR required for BER=10^{-7} is greater than or equal to target margin in dB. If both worst-case target margin and current-condition target margin are specified, then the capabilities exchanged shall be the intersection of data rates calculated using each noise condition separately.

The use of negative target margins with respect to reference worst-case noise corresponds to reference noise with fewer disturbers. This may be applicable when the number of disturbers is known to be substantially fewer than specified by the reference worst-case noise. Use of negative target margins with respect to current-conditions is not advised. Use of the current-condition target margin mode may result in retrains if the noise environment changes significantly.

6.4.1

PMMS Target Margin - If worst-case target margin is selected, target margin is relative to reference worst-case crosstalk specified in Table A-13 and Table B-14. If current-condition target margin is selected, specified target margin is relative to noise measured during line probe. The 5 bit target margin is specified by (bits 5-1 x 1.0 dB) - 10 dB. For example, 101111_2 in the worst-case PMMS target margin octet corresponds to 15 dB - 10dB = 5dB target margin relative to reference worst-case noise.

3.1.2 Annex A

A.5.6 PMMS Target Margin

If the optional line probe is selected during the G.994.1 session, the receiver shall use the negotiated target margin. If worst-case PMMS target margin is selected, then the receiver shall assume the disturbers of Table A-13 to determine if a particular rate can be supported. Reference crosstalk shall be computed as defined in A.3.3 with the FEXT components in A.3.3.9 ignored. The reference crosstalk specified in this section may not be representative of worst-case conditions in all networks. Differences between crosstalk environments may be compensated by adjusting the target margin.

Table A-13: Reference disturbers used during PMMS for worst-case target margin

Rate (kbps)	PSD (direction)	Reference disturber
all	symmetric (US/DS)	49 SHDSL
768/776	asymmetric (US)	49 HDSL
768/776	asymmetric (DS)	24 T1+24 HDSL
1536/1544	asymmetric (US)	39 SHDSL (NEXT only)
1536/1544	asymmetric (DS)	24 T1+24 SHDSL (NEXT only)

3.1.3 Annex B

B.5.6 PMMS Target Margin

If the optional line probe is selected during the G.994.1 session, the receiver shall use the negotiated target margin. If worst-case PMMS target margin is selected, then the receiver shall assume the disturbers of Table B-14 to determine if a particular rate can be supported. Reference crosstalk shall be computed using the cable crosstalk models of B.3.5.2, assuming infinite loop length so that FEXT components are ignored and NEXT is independent of loop length. The reference crosstalk specified in this section may not be representative of worst-case conditions in all networks. Differences between crosstalk environments may be compensated by adjusting the target margin.

Table B-14: Reference disturbers used during PMMS for worst-case target margin

Rate (kbps)	PSD (direction)	Reference disturber

all	symmetric (US/DS)	49 SHDSL
2048	asymmetric (US)	49 SHDSL-SYM with fsym=685333 Hz
2048	asymmetric (DS)	49 SHDSL-SYM with fsym=685333 Hz
2304	asymmetric (US)	49 SHDSL-SYM with fsym=770667 Hz
2304	asymmetric (DS)	49 SHDSL-SYM with fsym=770667 Hz

3.2 G.hs

Four new octets for Annex A and Annex B operation are proposed:

Table 11.14.3.12/G.994.1 – Standard information field – G.991.2 Annex A Downstream PMMS parameters - NPar(3) coding – Octet 13

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A downstream PMMS NPar(3)s – Octet 13
x	x	1	x	x	x	x	x	Worst-case PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	0	0	0	0	0	No parameters in this octet

Table 11.14.3.13/G.994.1 – Standard information field – G.991.2 Annex A Downstream PMMS parameters - NPar(3) coding – Octet 14

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A downstream PMMS NPar(3)s – Octet 14
x	x	1	x	x	x	x	x	Current-condition PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	0	0	0	0	0	No parameters in this octet

Table 11.14.4.12/G.994.1 – Standard information field – G.991.2 Annex A Upstream PMMS parameters - NPar(3) coding – Octet 13

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A upstream PMMS NPar(3)s – Octet 13
x	x	1	x	x	x	x	x	Worst-case PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	0	0	0	0	0	No parameters in this octet

Table 11.14.4.13/G.994.1 – Standard information field – G.991.2 Annex A Upstream PMMS parameters - NPar(3) coding – Octet 14

Bits 8	7	6	5	4	3	2	1	G.991.2 Annex A upstream PMMS NPar(3)s – Octet 14
x	x	1	x	x	x	x	x	Current-condition PMMS target margin (dB) (bits 5-1 x 1.0 dB - 10 dB)
x	x	0	0	0	0	0	0	No parameters in this octet

These octets should be duplicated as Tables 11.16.3.12, 11.16.3.13, 11.16.4.12, 11.16.4.13 respectively for Annex B PMMS parameters.

4. Summary:

1. This item should be presented under G.shdsl.
2. We propose that the text from section 3.1 of this contribution be included in the G.shdsl draft recommendation.
3. We propose that the octets from section 3.2 of this contribution be included in the G.hs-bis draft recommendation.